

“Version of Claims with Markings to Show Changes Made.” Claims 1 – 14, 16, 18, and 20 – 29 remain pending.

Regarding the Final Office Action:

In the Final Office Action, the Examiner rejected claims 1 and 8 under 35 U.S.C. § 112, 2nd paragraph, as being indefinite; rejected claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b) as anticipated by Livesay, et al. (PCT Int’l Publication No. WO 96/36070) (“Livesay-1”); rejected claims 6 and 13 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Livesay, et al. (U.S. Patent No. 5,003,178) (“Livesay-2”); rejected claims 16 – 19 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Goo, et al. (U.S. Patent No. 5,989,983); and objected to claims 5 and 12 as being dependent upon a rejected base claim, but indicated that they would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants appreciate the Examiner’s thorough examination of this application, especially the detailed citations which aided Applicants in reviewing the Examiner’s comments and the indication of allowable subject matter in the application. Applicants respectfully traverse the objections and rejections, as detailed above, for the following reasons.

Regarding the Rejection of Claims 1 and 8 under 35 U.S.C. § 112, 2nd paragraph:

In response to the Examiner’s rejection, Applicants have amended claim 1 to remove the term “predetermined.” In addition, Applicants note that claim 8 depends from claim 1, and does not contain the term “predetermined.” Applicants therefore deem the Examiner’s rejection of claims 1 and 8 overcome, and accordingly request withdrawal of the rejection.

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Regarding the rejection of claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b):

Applicants respectfully traverse the rejection of claims 1 – 4, 7 – 11, 14, and 15 under 35 U.S.C. § 102(b) as anticipated by Livesay-1. The rejection of claim 15 has been rendered moot by the cancellation of this claim.

In order to properly establish that Livesay-1 anticipates Applicants' claimed invention under 35 U.S.C. § 102, each and every element of each of the claims in issue must be found, either expressly described or under principles of inherency, in that single reference. Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." See M.P.E.P. § 2131, p. 2100-69, quoting *Richardson v. Suzuki Motor Co.*, 868 F.2d 1126, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). Regarding the 35 U.S.C. § 102(b) rejection, Livesay-1 does not teach each and every element of Applicants' present invention as claimed.

Regarding the rejection of claim 1, the Examiner alleged, "[Livesay-1] discloses ... heating the substrate in a reactor chamber (pg. 8[,] lines 19-25), changing at least one [] parameter selected from the group consisting of ... temperature of the substrate (pg. 9[,] lines 15-23), ..." (Final Office Action, p. 3). Applicants note the Examiner points to Livesay-1's disclosure that "[i]n the preferred embodiment of the invention the wafer is simultaneously heated by the infrared lamps and irradiated by the electron beam throughout the entire process" (Livesay-1, p. 9, ll. 17 – 19).

Applicants point out that Livesay-1 teaches that a wafer is simultaneously heated by an infrared lamp and irradiated by an electron beam (Livesay-1, col. 6, ll. 18 – 25), however, the wafer temperature is kept at a temperature between 200 – 250°C by turning the lamp off and on at a varying duty cycle. In other words, the wafer temperature is kept approximately constant.

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Therefore, the temperature of the substrate may vary only slightly as a result of being irradiated by an infrared lamp or an electron beam, but is not changed, contrary to the recitation in Applicants' claim ("causing to change a temperature of the substrate from a first heating temperature to a second heating temperature during the electron beam irradiating process").

Thus, since Livesay-1 does not disclose each and every element of Applicants' independent claim 1, Livesay-1 does not anticipate Applicants' claimed invention. In addition to Livesay-1 not anticipating the present invention, Livesay-1 does not disclose an identical invention, let alone in as complete detail as contained in Applicants' independent claim 1. Applicants submit that the Examiner has not met these essential requirements of anticipation for a proper 35 U.S.C. § 102(b) rejection.

Therefore, Applicants submit that independent claim 1 is allowable, for the reasons already argued above. In addition, dependent claims 8 – 11 and 14 are also allowable at least by virtue of their respective dependency from allowable base claim 1; and dependent claims 2 – 4 and 7 are also allowable at least by virtue of their respective dependency from allowable base claim 20, which contains recitations similar to independent claim 1. Therefore, Applicants respectfully submit that the improper 35 U.S.C. § 102(b) rejection of claims 1 – 4, 7 – 11, and 14 should be withdrawn.

Regarding the rejection of claims 6 and 13 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 6 and 13 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Livesay-2, respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. See M.P.E.P. § 2143, 8th Ed., Aug. 2001, pp. 2100-122 – 127.

The Examiner does not show that all the elements of Applicants' claims are met in the cited references, taken alone or in combination, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

Furthermore, regarding dependent claims 6 and 13, "Examiners are reminded that a dependent claim is directed to a combination including everything recited in the base claim and what is recited in the dependent claim. It is this combination that must be compared with the prior art, exactly as if it were present as one independent claim." M.P.E.P. § 608.01(n)(III), p. 600-77.

Livesay-2, taken alone or in combination with Livesay-1, still does not teach or suggest those recitations of Applicants' independent claim 1 not taught or suggested by Livesay-1.

Applicants have already demonstrated above that Livesay-1 does not teach or suggest all the recitations of Applicants' independent claims 1 or 20, and therefore, for at least the reasons stated above, Applicants' claims 6 and 13 are not obvious.

In addition, the Examiner admitted deficiencies in Livesay-1, in that it "does not teach that the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam"

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(Final Office Action, p. 6), yet alleges Livesay-2 would cure this deficiency. Nevertheless, Applicants note that Livesay-2 still does not cure the deficiencies of Livesay-1 pertaining to the elements of independent claim 1.

The Examiner alleged Livesay-2 “teaches in figure 3 adjusting the position of the substrate (30) in a range from not less than 50 mm to not more than 120 mm in distance from an electron generating section that generates the electron beam (col. 6, lines 15-26)” (Final Office Action, p. 6). Applicants note, however, that Livesay-2 does not cure the deficiencies of Livesay-1, in part because Livesay-2 does not teach or suggest at least “heating the substrate at a heating temperature in a reactor chamber, and causing to change a temperature of the substrate from a first heating temperature to a second heating temperature during the electron beam irradiating process” (Applicants’ claim 1). In contrast, Livesay-2 discloses “[e]lectron beam exposure of the resist provides nonthermal means of crosslinking and hardening the resist. The *substrate stays at room temperature* yet the resulting exposed resist is fully crosslinked without pattern flow” (Livesay-2, col. 7, ll. 31 – 35. emphasis added). This is clearly different from Applicants’ claimed invention. Thus Livesay-1 or Livesay-2, taken alone or in combination, cannot produce Applicants’ claimed invention.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” See M.P.E.P. §§ 2142, 2143, and 2143.03.

Even though Livesay-1 does not teach or suggest all the features of Applicants’ claimed invention, the Examiner’s application of Livesay-2 as a reference in the rejection of dependent claims 6 and 13 does not render the recitations of Applicants’ claims obvious. Even if the Examiner’s characterization of Livesay-1 or Livesay-2 (See Office Action, pp. 4 – 5) were

correct (which Applicants dispute), this still does not establish that there would have been the requisite suggestion or motivation to modify Livesay-1 with Livesay-2. For example, Livesay-1 discloses that “[i]n the preferred embodiment of the invention the wafer is simultaneously heated by the infrared lamps and irradiated by the electron beam throughout the entire process” (Livesay-1, p. 9, ll. 17 – 19). In contrast, Livesay-2 discloses that “[t]he substrate stays at room temperature...” (Livesay-2, col. 7, ll. 33 – 34). Thus, there can be no motivation to combine these references, as they do not teach or suggest the elements of Applicants’ independent claim 1 or dependent claims 6 and 13 (by virtue of their respective dependence from claims 1 and 20).

Therefore, for the reasons just presented, there is no suggestion or motivation to modify Livesay-1 with Livesay-2 (or vice versa) to produce Applicants’ claimed invention. Even if the Examiner’s allegations that “it would have been obvious... to modify the process of Livesay-1” (Office Action, p. 5), were true (which Applicants dispute), this still does not establish that there would have been the requisite suggestion or motivation to modify either Livesay-1 or Livesay-2 to produce Applicants’ claimed invention. “The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.” M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990) (emphasis in original).

Since Livesay-1 and Livesay-2, taken alone or in combination, do not teach or suggest all the recitations of Applicants’ claimed invention, and there can be no suggestion or motivation in the cited references to modify them. Applicants submit that the cited references do not suggest the desirability of their modification to produce Applicants’ present invention.

Thus, dependent claims 6 and 13 are allowable for the reasons presented herein, in addition to being allowable at least by virtue of their respective dependence from allowable base

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claims 1 and 20. Therefore, Applicants respectfully submit that the Examiner should withdraw the improper 35 U.S.C. § 103(a) rejection.

Regarding the rejection of claims 16 – 19 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 16 – 19 under 35 U.S.C. § 103(a) as unpatentable over Livesay-1 in view of Goo, respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established. The rejection of claims 17 and 19 have been rendered moot by the cancellation of these claims.

The requirements for the Examiner to establish a *prima facie* case of obviousness were set forth in the previous section. Furthermore, Applicants note dependent claims 16 and 18 are directed to a combination including everything recited in the base claim and what is recited in the dependent claim. See M.P.E.P. § 608.01(n)(III), p. 600-77.

Applicants have already demonstrated above that Livesay-1 does not teach or suggest all the recitations of Applicants' independent claim 1. Therefore, for at least the reasons stated above, Applicants' claims 16 and 18, dependent from claim 1, are not obvious over Livesay-1 standing alone.

Moreover, Goo, taken alone or in combination with Livesay-1, still does not teach or suggest those recitations of Applicants' independent claim 1 (and therefore claims 16 – 19 as well) not taught or suggested by Livesay-1. While Goo teaches "curing the SOG layer by irradiating the SOG layer with an electron beam [and] [t]he microelectronic substrate is preferably simultaneously heated to a temperature below about 500°C" (Goo, col. 3, ll. 61 – 63), Goo also teaches that "[w]hen the electron beam 18 is used, the curing can be performed at room temperature" (Goo, col. 5, ll. 31 – 35). Regardless of whether Goo teaches "embedding a wire

whose main material is Cu" (Final Office Action, p. 7), Goo still does not teach or suggest at least Applicants' claimed "heating the substrate at a heating temperature in a reactor chamber, and causing to change a temperature of the substrate from a first heating temperature to a second heating temperature during the electron beam irradiating process" (claim 1).

The Examiner admitted additional deficiencies in Livesay-1, stating that Livesay-1 "does not teach that the insulation film is a polymethylsiloxane film" and "does not teach that the wire's main material is Cu on a surface of an insulation film" (Final Office Action, p. 7). In addition, Applicants note, despite the Examiner's subsequent allegations that it would have been obvious to apply Goo to Livesay-1's disclosure to allegedly cure Livesay-1's deficiencies, Livesay-1 and Goo's disclosures are not combinable to produce Applicants' claimed invention, in part because Goo does not teach or suggest all of the features of Applicants' claim 1 not taught or suggested by Livesay-1.

The Examiner has therefore not met at least one of the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

Since Livesay-1 and Goo, taken alone or in combination, do not teach or suggest all the recitations of Applicants' claimed invention, there can be no suggestion or motivation in the cited references to modify Livesay-1 with Goo. Applicants submit that the cited references do not suggest the desirability of their modification to produce Applicants' present invention, and do not yield any reasonable expectation of success from their combination. Thus, Applicants submit that the Examiner's reliance on Livesay-1 and Goo fails to establish *prima facie* obviousness.

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Thus, dependent claims 16 and 18 are allowable for the reasons presented herein, in addition to being allowable at least by virtue of their dependence from allowable base claim 1. Therefore, Applicants respectfully submit that the Examiner should withdraw the 35 U.S.C. § 103(a) rejection.

Regarding New Claims 20 – 29:

Finally, Applicants have introduced new claims 20 – 29 to provide coverage for other aspects of Applicants' invention. Applicants submit that the new claims are supported by the originally filed application, and therefore do not constitute new matter.

Conclusion:

In view of the foregoing remarks, Applicants request reconsideration of the application, and submit that the rejections detailed above are improper and should be withdrawn. Applicants submit that pending claims 1 – 14, 16, 18, and 20 – 29 are in condition for allowance. A favorable action is requested.

Should the Examiner continue to dispute the patentability of the claims after consideration of this Amendment, Applicants encourage the Examiner to contact Applicants' undersigned representative by telephone to discuss any remaining issues or to resolve any other misunderstandings.

Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed,

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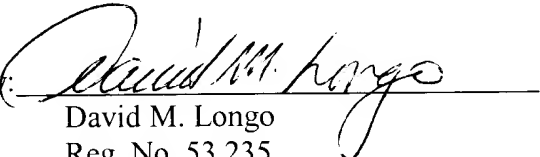
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including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: May 21, 2003

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APPENDIX TO AMENDMENT OF May 21, 2003

Version of Claims with Markings to Show Changes Made

AMENDMENTS TO THE CLAIMS:

Please amend claims 1, 2, and 4 – 7 as follows.

1. (Twice Amended) A method of manufacturing a semiconductor device comprising:
preparing a substrate to be treated; and

forming an insulation film above the substrate, which includes applying an insulation film raw material above the substrate, the insulation film raw material including a substance or a precursor of the substance, the insulation film comprising the substance, curing the insulation film raw material by irradiating an electron beam on the substrate while heating the substrate at a heating temperature in a reactor chamber, and causing to change [changing at least one of the parameters selected from the group consisting of pressure in the reactor chamber,] a temperature of the substrate[, type of gas having the substrate exposed thereto, flow rate of a gas introduced into the reactor chamber, position of the substrate, and quantity of electrons incident to the substrate per unit time when the electron beam is being irradiated on the substrate,

wherein the substrate temperature is changed by a predetermined amount] from a first heating temperature to a second heating temperature during the electron beam irradiating process.

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2. (Amended) A method of manufacturing a semiconductor device according to claim [1] 20, wherein the pressure in the reactor chamber is changed in a range from higher than 0 Torr to not more than 40 Torr.

4. (Amended) A method of manufacturing a semiconductor device according to claim [1] 20, wherein type of gas having the substrate exposed thereto is changed among a nitrogen gas, a rare gas, a reduced gas and a mixture of these gases, and whose oxygen concentration is not higher than 100 ppm.

5. (Amended) A method of manufacturing a semiconductor device according to claim [1] 20, wherein the flow rate of gas having the substrate exposed thereto, the gas being introduced into the reactor chamber, is changed in a range of from higher than 0 slm to not more than 25 slm.

6. (Twice Amended) A method of manufacturing a semiconductor device according to claim [1] 20, wherein the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam.

7. (Amended) A method of manufacturing a semiconductor device according to claim [1] 20, wherein the quantity of electrons incident to the substrate per unit time is changed in a range from not less than $4 \mu\text{C}/\text{cm}^2\cdot\text{sec}$ to not more than $10 \mu\text{C}/\text{cm}^2\cdot\text{sec}$.

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